(12) UK Patent Application (19) GB (11) 2 006 922 A

(21) Application No 7841810
(22) Date of filing 24 Oct 1978
(23) Claims filed 24 Oct 1978
(30) Priority data
(31) 2748123
(32) 27 Oct 1977
(33) Fed Rep of Germany (DE)
(43) Application published
10 May 1979
(51) INT CL²
F16C 13/00//
B29C 5/04
(52) Domestic classification
F2U 21A 21B 21C 21X
B5A 1R314C1A 1R415
20T6 B15
(56) Documents cited
GB 1405679
GB 1371002
GB 1243602
GB 949344
GB 751932
(58) Field of search
F2U
(71) Applicants
Eduard Kusters,
Gustav-Funders-Weg 18,
4150 Krefeld, Federal
Republic of Germany
(72) Inventors
Werner Hartmann
Eduard Kusters
(74) Agents
Forrester, Ketley & Co

(54) Improvements in or Relating to a Roller

(57) A roller has an outer periphery of plastics material. Metal particles are embedded in the plastics material to improve the thermal conductivity to enable the plastics to be cooled adequately. The roller is formed by a centrifugal casting technique. The metal particles may be present in the form of powder, flakes or fibres.

GB 2 006 922 A

SPECIFICATION

Improvements in or relating to a Roller

The invention relates to a roller and more particularly to a roller for the pressure treatment of webs of material.

It has been proposed to provide a roller having an operative periphery formed of a plastics material, such as nylon for use in pressure treating a web of paper to improve the surface of the paper.

When plastics materials are used as a material for rollers of this kind the material flexes as the rollers rotate, since plastics materials are not completely rigid indeed, they are used for this particular job precisely because they are resilient. The flexing helps to increase the temperature of the plastics material in operation of the roller. These effects are important only in the case of rollers whose operative surface consists of a compact plastics material composition, and rollers of this kind will be considered herein.

As mentioned above, one particular important use of such rollers, is the smoothing and glazing of paper webs, and for this purpose it is presently preferred that rollers having a nylon outer surface are used. During such smoothing and glazing the linear pressure and the working speed are so high that the resulting temperature increases of the roller may destroy the roller material. Zones form below the roller surface in which bubbles form and there are inner separations or delaminations, of the plastics material, since the heat conductivity of the plastics material is so low that the heat evolved inside the plastics material cannot be removed fast enough radially outwards to the passing web or radially inwards to the inner roller.

The same problems occur in rollers which have a plastics material covering rigidly secured to an inner roller and in rollers which are of the kind disclosed by German Auslegeschrift 1 222 882 and in which a tubular plastics material roller rotates around a smaller inner roller and in contact with a backing roller.

The thickness of the plastics material layer cannot be less than a certain minimum if the required effects are to be provided, for instance, the glazing effects in the case of nylon rollers. It has therefore so far proved to be virtually useless to cool the inner roller or backing roller since the distances over which the heat must be removed from the inside of the plastics material layer are too great, having regard to the poor heat conductivity of the plastics material, for the heat evolved to be removed fast enough to prevent overheating of the internal regions of the plastics material.

It is an object of the invention to provide a roller which obviates or reduces the above described disadvantages of prior rollers.

According to one aspect of the invention, there is provided a roller for the pressure treatment of webs of material, the operative periphery of the roller being of plastics material there being fine metal particles embedded uniformly around the periphery of the roller in the plastics material to improve the heat conductivity thereof.

According to another aspect of this invention, there is provided a centrifugal casting process for making such a roller wherein a liquid plastics material starting phase containing the metal particles in dispersed form is centrifuged.

According to yet another aspect of this invention, there is provided a centrifugal casting process for making a roller wherein the metal particles are applied from the inside to the rotating plastics starting phase whilst it is still liquid.

It will be appreciated that the underlying idea of the invention is to make use of the good heat conductivity of metals to improve the removal of heat from the plastics material whilst retaining the treatment effect of the plastics material. Only fine particles are embedded in the matrix of the otherwise compact plastics material composition to enable the plastics to function as in the prior proposed rollers. The metal particles depend, for their effect, on the fact that the heat evolved is transmitted more rapidly from one end to the other of the discrete metal particles than through a corresponding region of the plastics material. Although the discrete particles do not cohere with one another and are surrounded by plastics material, the metal particle constituents nevertheless improve the heat conductivity of the composite material.

In one embodiment of the invention, the metal particles can be present in powder form.

Most metals are commercially available in powder form. The powders are in the form of small grains which, statistically considered, have substantially the same size in all three dimensions. The grains on their own are fairly rigid, and so including the grains in the plastics material increases the hardness of the plastics material, something which may not always be desirable.

Conveniently, therefore, the metal particles in the material of the roller periphery can be shaped in a manner which enables the plastics material to be more readily deformable; for instance, the metal particles can be present in the form of flakes, whose mass is distributed substantially in two dimensions, or even in the form of fibres, in which the mass is present substantially in one dimension only. Flakes and fibres are more readily deformable than powder grains and therefore adapt more readily to deformations of the supporting matrix of plastics material.

To give some idea of the density of distribution of the metal particles, the same should be statistically spaced apart from one another by an amount of the order of magnitude of their dimensions.

According to an important feature of the invention, the particles can consist of a low density metal.

This feature is important in the production of

the rollers and is intended to prevent the distribution of the metal particles in the plastics material composition from becoming irregular. If the rollers according to the invention are produced e.g. by centrifugal casting as described in German Auslegeschrift 1 214 865, the metal particles may be displaced radially outwards in the event of considerable difference in specific weight between the metal particles and the liquid plastics material phase, with the result that the metal particles in practice accumulate on the roller surface, which is, of course, undesirable. This unwanted phase separation does not occur so readily in the case of metal particles having a low specific weight close to that of the liquid plastics material phase.

To this end, the particles are preferably aluminium of magnesium, or alloys of these metals.

The rollers according to the invention can be produced by the centrifugal casting process described in German Auslegeschrift 1 214 865 a liquid plastics material strating phase which contains the metal particles in a dispersed form being centrifuged to form the periphery of a roller.

Alternatively, first a liquid plastics material starting phase devoid of metal particles is centrifuged and allowed at least to start to gel, whereafter the plastics material starting phase containing the metal particles is centrifuged aa inner layer.

This process has the advantage that the surface layer of the roller consists of pure plastics material and its treatment properties (for treating a web) are unaffected by the metal filling.

Another possibility, however, is to make good use of the theoretically unwanted effect of the heavier metal particles shifting as a result of inertia forces; to this end, in the production of the roller the metal particles are applied from the inside to the liquid rotating plastics material starting phase. In centrifuging the metal particles work through the liquid phase and finally are distributed throughout the then solidified plastics material.

Claims

1. A roller for the pressure treatment of webs of material, the operative periphery of the roller being of plastics material there being fine metal particles embedded uniformly around the periphery of the roller in the plastics material to improve the heat conductivity thereof.

2. A roller according to claim 1, wherein the metal particles are present in powder form.

3. A roller according to claim 1, wherein the metal particles are present in flake form.

4. A roller according to claim 1, wherein the metal particles are present in fibre form.

5. A roller according to any of claims 1 to 4, wherein the metal particles are statistically spaced apart from one another by a distance substantially equal to the magnitude of their average dimensions.

6. A roller according to any of claims 1 to 5, wherein the particles consist of a low-density metal.

7. A roller according to claim 6, wherein the particles are of aluminium or aluminium alloy.

8. A roller according to claim 6, wherein the particles are magnesium or magnesium alloy.

9. A roller according to any one of the preceding claims wherein the plastics material is nylon.

10. A centrifugal casting process for the production of the roller according to any one of claims 1 to 9, wherein a liquid plastics material starting phase containing the metal particles in dispersed form is centrifuged.

11. A process according to claim 10, wherein first a liquid plastics material starting phase devoid of metal particles is centrifuged and allowed at least to start to gel, whereafter the plastics material starting phase containing the metal particles is centrifuged as inner layer.

12. A centrifugal casting process for the production of the roller according to any one of claims 1 to 9, wherein the metal particles are applied from the inside to the rotating plastics starting phase whilst it is still liquid.

13. A roller whenever made by a method according to any one of claims 10 to 12.

14. A roller according to claim 1 and substantially as herein described.

15. A centrifugal casting process substantially as herein described.

16. Any novel feature or combination of features described herein.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1979. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.